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Comparison of General Anesthesia and Conscious Sedation During Computed Tomography–Guided Radiofrequency Ablation of T1a Renal Cell Carcinoma

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Abstract

Purpose: Percutaneous radiofrequency ablation is so painful that this treatment requires pain control such as conscious sedation or general anesthesia. It is still unclear which type of anesthesia is better for treatment outcomes of renal cell carcinoma. This study aimed to compare general anesthesia and conscious sedation in treating patients with renal cell carcinoma with radiofrequency ablation.

Methods: Between 2010 and 2015, 51 patients with biopsy-proven renal cell carcinomas (<4 cm) were treated with computed tomography–guided radiofrequency ablation. General anesthesia was performed in 41 and conscious sedation was performed in 10 patients. Tumour size, local tumour progression, metastasis, major complication, effective dose, glomerular filtration rate difference, and recurrence-free survival rate were compared between these groups.

Results: The mean tumour size was 2.1 cm in both groups ($P = .673$). Local tumour progression occurred in 0% (0 of 41) of the general anesthesia group, but in 40% (4 of 10) of the conscious sedation group ($P = .001$). Metastases in these groups occurred in 2.4% (1 of 41) of the general anesthesia group and 20% (2 of 10) of the conscious sedation group ($P = .094$). No major complications developed in either group after the first radiofrequency ablation session. The mean effective doses in these groups were 21.7 mSv and 21.2 mSv, respectively ($P = .868$). The mean glomerular filtration rate differences in the general anesthesia and conscious sedation groups were $-13.5 \text{ mL/min/1.73 m}^2$ and $-19.1 \text{ mL/min/1.73 m}^2$, respectively ($P = .575$). Three-year recurrence-free survival rates in these groups were 97.6% and 60.0%, respectively ($P = .001$).

Conclusions: General anesthesia may provide better intermediate outcomes than conscious sedation in treating small renal cell carcinomas with radiofrequency ablation.

Résumé

Object : L'ablation par radiofréquence percutanée est une forme de traitement si douloureuse qu'elle nécessite une prise en charge de la douleur par sédation consciente ou anesthésie générale. Le type d'anesthésie le plus efficace pour le traitement de l'hypernéphrome n'a pas encore été déterminé. L'étude vise donc à comparer l'efficacité de l'anesthésie générale et de la sédation consciente chez les patients faisant l'objet d'une ablation par radiofréquence pour le traitement d'un hypernéphrome.

Méthodes : Entre 2010 et 2015, 51 patients présentant un hypernéphrome confirmé par biopsie (moins de 4 cm) ont subi une ablation par radiofréquence guidée par tomographie assistée par ordinateur. En tout, 41 interventions ont été pratiquées sous anesthésie générale et 10, sous sédation consciente. Les caractéristiques des deux groupes ont été comparées: taille de la tumeur, évolution locale de la tumeur, métastases, complications majeures, dose efficace, variation du débit de filtration glomérulaire et taux de survie sans récurrence.

Résultats : En moyenne, la tumeur mesurait 2,1 cm au sein des deux groupes ($P = 0,673$). Aucune évolution locale de la tumeur n'a été observée chez les 41 patients sous anesthésie générale (0 %), alors qu'une évolution locale a été observée chez 40 % des patients sous sédation consciente (4 sur 10) ($P = 0,001$). Ensuite, 2,4 % des patients sous anesthésie générale (1 sur 41) ont présenté des métastases, contre 20 % des patients sous sédation consciente (2 sur 10) ($P = 0,094$). Aucun patient n'a développé de complications majeures au terme de la première séance d'ablation par radiofréquence. Une dose efficace moyenne de 21,7 mSv a été mesurée chez les patients sous anesthésie

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générale, contre 21,2 mSv chez ceux sous sédation consciente ($P = 0,868$). Les variations du débit de filtration glomérulaire ont été calculées dans les deux groupes: -13,5 mL/min/1,73 m² chez les patients sous anesthésie générale, contre -19,1 mL/min/1,73 m² chez les patients sous sédation consciente ($P = 0,575$). Enfin, le taux de survie sans récurrence à trois ans s'est chiffré à 97,6 % et à 60,0 %, respectivement ($P = 0,001$).

Conclusion : À moyen terme, l'anesthésie générale pourrait s'avérer plus efficace que la sédation consciente dans le traitement d'un petit hypernéphrome par ablation par radiofréquence.

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Key Words: Ablation techniques; Carcinoma; Conscious sedation; General anesthesia; Renal cell

Radiofrequency ablation (RFA) has been accepted as minimally invasive treatment for small renal cell carcinoma (RCC) in patients who are poor surgical candidates [1–10]. However, pain control is essential during RFA procedures because this heat-based ablation is more painful than cryoablation [11]. Therefore, conscious sedation (CS) [1–5], general anesthesia (GA) [7,10], or both [6,8,9] have been performed to reduce pain resulting from percutaneous RFA.

Previously, we used CS alone during RFA, but we found that it did not work well in some patients because their pain was not controlled well. Recently, we have changed from CS to GA for pain control. However, it is unclear which type of anesthesia is better for the treatment outcomes. Our hypothesis was that GA contributes to treatment outcome with RFA by means of better controlling pain than CS. The purpose of our study was to compare GA and CS in treating patients with small RCC with percutaneous RFA.

Methods

This retrospective study was approved by our institutional review board and informed consent was waived.

Patients

Between January 2010 and December 2014, 51 patients (40 men and 11 women; median age 57 years; age range 34–80 years) with 51 RCCs were included in the analyses (Table 1). These patients' clinical stages were all T1aN0M0 based on pre-RFA computed tomography (CT) or magnetic resonance imaging (MRI). Prior to RFA, renal mass biopsies

were performed under ultrasonography ($n = 47$) or CT ($n = 4$) guidance. The maximum diameters of the RCC were measured on axial, sagittal, or coronal CT or MRI. The mean tumour size was 2.1 cm (median 2.1 cm; range 1.0–3.9 cm). The RCC subtypes were clear cell ($n = 41$), papillary ($n = 2$), chromophobe ($n = 2$), and unclassified ($n = 6$). Our previous RFA cases undergoing CS were not included because they had barely histology proven RCC and were not consecutive [5]. An interventional radiologist had experienced 7-year RFA experience before treating the first case in our study. All of these patients were also evaluated in another study in terms of midterm RFA outcomes [12].

Anesthesia Procedures

For pain control, CS or GA was performed during the RFA. CS was performed in 10 patients who underwent RFA before June 2011. Many of these patients complained of severe pain, which made it difficult to perform the RFA procedure. After June 2011, GA was performed in 41 patients. In the CS group, 1–2 mg midazolam (Buwang Pharmaceutical Co Ltd, Seoul, Republic of Korea) and 50–100 µg fentanyl (Hana Pharm Co Ltd) were injected intravenously.

In the GA group, anesthesia was induced with 5 mg/kg of thiopental sodium (JW Pharmaceutical Co Ltd, Seoul, Republic of Korea) or 2 mg/kg of propofol (Daewon Pharm Co Ltd, Seoul, Republic of Korea), sevoflurane (Hana Pharm Co Ltd), and 0.6–1.0 mg/kg of rocuronium bromide (MSD Korea Ltd, Seoul, Republic of Korea) or 0.15–0.2 mg/kg of cisatracurium besylate (GlaxoSmithKline Korea, Seoul, Republic of Korea). After tracheal intubation, anesthesia was maintained with sevoflurane (1.1–3.4 vol%) with O₂ (2 L/min). Volume-controlled mechanical ventilation was performed with a tidal volume of 6–10 mL/kg, and the respiratory rate was adjusted to maintain the end-tidal CO₂ pressure between 30–40 mm Hg.

RFA Procedures

CT-guided RFA procedures were performed by a radiologist who had 7 years of RFA experience at the time of the first case and 11 years of experience at the time of the last case. A CT scanner (Aquilion, Toshiba Medical Systems

Table 1

Patient demographics

Patient demographics	RFA groups according to types of anesthesia		P value
	Conscious sedation	General anesthesia	
Age, y	57 (42-75)	57 (34-80)	.884
Male:female	9:1	31:10	.428
BMI, kg/m ²	23.8 ± 2.8	24.3 ± 3.4	.677
RCC size, cm	2.1 (1.0-3.2)	2.1 (1.0-3.9)	.673
Clear cell RCC, %	100 (10/10)	75.6 (31/41)	.178

BMI = body mass index; RCC = renal cell carcinoma; RFA = radiofrequency ablation.

Values are median (interquartile range), mean ± SD, or % (n/n), unless otherwise indicated.

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